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ABSTRACT

The Project on Instructional Criteria has attempted to develop a methodology for evaluation of computer service for instructional purposes. Through site visits, letters, surveys of institutions and of recent literature, and interviews, existing practices were investigated. Alternative techniques were designed and tested for measuring quality, quantity, and user needs. The outcomes are summarized and explained in a guidebook to the evaluation of computing, "Evaluating Instructional Computing: Measuring Needs and Resources for Computing in Higher Education." It provides a review of the instructional uses of computing, recommends techniques for the measurement of the quality and quantity of computing, and suggests techniques that evaluate alternatives on an individual campus. (EMH)

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CRITERIA FOR
INSTRUCTIONAL COMPUTING EVALUATION
IN HIGHER EDUCATION

Final Technical Report

submitted to

Technological Innovations in Education Group

Office of Experimental Projects and Programs

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U S DEPARTMENT OF HEALTH, EDUCATION & WELFARE
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Institution: University of California, Irvine

Dates: April 15 to May 31, 1976

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CRITERIA FOR INSTRUCTIONAL COMPUTING EVALUATION IN HIGHER EDUCATION

The evaluation of the resources of higher education in terms of their impact on education has always been a difficult matter. And so it is with computing, one of the newest resources to be applied to the educational process. There is general agreement that access to computing is of value to students at all levels and in virtually all disciplines, that some kinds of computing are of more value than others, and that students will, if it is available, absorb considerable amounts of high quality computing. But attempts to quantify the need or to define kinds or quality of computing have usually resulted in no consensus at all. Examination of the practice of institutions provides little guidance, since it covers such a wide range as to reveal totally different approaches and totally different decisions.

The subject is of more than casual or theoretical interest because it impinges on many practical decisions at all levels in the educational hierarchy. Administrators, legislators, and faculty are anxious to identify standards of quality and to define procedures for the evaluation of

educational computing: ideally in terms of academic quality but at least in terms of the financial investment an institution should be making to computers in education.

Although periodic efforts have been made to survey colleges and universities about expenditures and hardware resources, no serious effort to establish a normative standard has taken place since the initial effort of the President's Science Advisory Board in 1967. No effort at all has been made to establish standards of quality independent of cost.

The intent of the Project on Instructional Criteria has been to develop a methodology for evaluating computer service for instructional purposes; these methods are intended to be useful in curriculum, administrative, budgetary, and accreditation activities.

A. Objectives and plan of attack

The primary goal of the project was the definition of useful guidelines for the assessment of computer service availability for students in higher education. The effort can be seen as being directed at finding answers to the following three questions.

What should be measured? In presenting facts about their use of computers, institutions use many different measures. It is important to consider what aspects of the complex interaction between institutions, students, and computers should be measured (and can be measured) in order to provide an indication of computer availability and its adequacy.

Alternatives include the amount of computing produced (in terms of jobs or hours), the cost of computing, the richness or quality of computing produced.

How should these be measured? In order to measure any of these parameters, some definitions are required. What constitutes a unit in student/computer interaction? How is the size of a student job to be measured? Can standardized measures of cost be obtained in comparable form from a large number of academic computer facilities?

How should the measurements be evaluated? If measures are defined along the lines suggested by the first two questions, the normative issue still has not been addressed: how much is enough? No single norm is likely to be satisfactory for all institutions. Requirements for computing availability differ markedly from one discipline to another, and between undergraduate and graduate instruction. Depending on commitment to different areas of instruction and different institutional goals, commitment of resources to computing will also differ.

The outcome of the study was planned to be a report, with information presented in a form that will be useful to individuals in education and government at several levels and for several purposes: for self-evaluation, for planning, for evaluating needs and resources.

B. Progress, problems, and changes

The first stage of the investigation was an effort to discover what might already have been done elsewhere. It seemed important to begin with a wide-ranging search for methods, procedures, and ideas that might serve as guidelines. Letters of inquiry were addressed to leading institutions, site visits were made, and people were interviewed. In response to these inquiries and interviews, we received many words of encouragement but little concrete help. Most people are aware of the need for standards but have little to offer by way of examples or methods. However, a few useful models did emerge.

In parallel with this investigation, an effort was made to approach the critical issues of what people measure and the terms of measurement they employ. Institutions were asked what kinds of units they use to account for computing resources and the categories they use to distinguish types of use. The results of this survey reveal some interesting aspects of institutional behavior, useful in developing guidelines in terms that will be meaningful to many institutions. The survey incidentally served to bring to the project copies of many internal documents and reports that were helpful in the search for examples of methods and procedures.

The third activity was a review of recent reports and surveys that include quantitative data on computer use in higher education. This provides a basis for assessing what institutions are currently doing and also for projecting the changes taking place in institutional commitments to computing.

Fourth, alternative techniques were designed and tested for measuring three important aspects of educational computing: quality, quantity, and user needs. These techniques involve the use of questionnaires and are described in the report which is the major outcome of the project.

No major problems were encountered in these activities. Still, it must candidly be admitted that less information, guidance, and help emerged from the literature and people in the field than had originally been hoped. Almost no institution can present a rigorous and logical model for decision making. The formulas of those institutions using concrete criteria for establishing levels of computing support are arbitrary and largely indefensible. They tend to be uneasy compromises between what faculty want and what institutions can afford, with little reference to what students need.

C. Significant findings and outcomes

In the face of this situation, hopes that we could produce clear and absolute standards satisfactory to all were bound to be defeated. Conclusions as unqualified and uncompromising as those of the President's Science Advisory Board, which recommended spending $65 per undergraduate student per year, are not now defensible on the basis of the data and are not likely to be accepted by institutions or decision makers. More flexible guidelines, acknowledging the difficulty of absolutes, will be more acceptable and more credible.

Therefore, the outcomes have been summarized and explained in the form of a guidebook to the evaluation of computing. Called Evaluating Instructional Computing: Measuring Needs and Resources for Computing in Higher Education, it is addressed to those interested in the educational role of computing on the campus. It indicates how the adequacy of computing on a particular campus can be assessed and how an institution can go about finding answers to its own questions about computing for student and faculty use. It begins by providing a review of the instructional uses of computing; it then recommends techniques for the measurement of the quality and quantity of computing; and it suggests techniques that evaluate alternatives on an individual campus. More simply, the questions addressed are these: What is instructional computing? Where are we now? Where do we go from here? The report falls into three parts, more or less along the lines of these three questions.

What is instructional computing? These chapters treat the nature and status of instructional computing in higher education. The need for student access to computing, the development of resources, and the evaluation of the effectiveness of use are the primary topics of the individual chapters. The chapter summaries are as follows.

"The need for standards" presents an introduction to the questions about the evaluation of instructional computing and reviews the problem of achieving generally acceptable standards. It concludes that, despite its newness, computing

has now become an integral part of education. Early estimates stressed the importance and impact computers would have on higher education and recommended appropriate levels of support. Although the importance and impact were not exaggerated, the recommended levels for instructional computing have yet to be achieved.

"Surveys and estimates of use" summarizes the data and conclusions of major surveys of the use of computers in higher education. Two very broad but important conclusions emerge. First, every year, more institutions use computers in education; more departments use computers; and more students are exposed to the use of computers. Second, on a national basis, expenditures for computers in higher education and the instructional use of computers continue to rise.

"Instructional effectiveness" reviews the ways in which computers are applied in the instructional process and the justification for their use. It concludes that "added cost for added value" is the major justification. However, quantitative assessments of the effectiveness of computers in the educational process are, at best, sketchy and incomplete. Better information is badly needed.

Where are we now? The middle part of the report presents an assessment of current use and recommends techniques for the measurement of quantity and quality of computing resources provided for students to use. The three chapters that make up this section are summarized below.

"What students do" considers the information available on the instructional techniques used in higher education and the way in which computers, courses, and students interact. The data indicate that most student computing is directed at learning about computers and using computers to solve problems. Tutorial and other techniques of computer-assisted instruction are not widely used in higher education. A further conclusion of the chapter is that, where computing is of high quality, where it is readily available, and where its use by students is encouraged, nearly all students (and faculty) will make some use of it. The value of student use is not necessarily in direct proportion to amount used or cost of the use. Most student users spend little time (or money) using the computer but this use is a very important educational experience. At the end of this chapter, some hypotheses or rules of thumb are suggested. They are intended to simplify and assist the process of planning for student computer use.

"Measuring quality" emphasizes the fact that all computing is not the same and that some kinds of computing resources are too poor or of the wrong kind to be utilized effectively by students. Qualitative aspects of computing are important if students are to use computing and if their use is to be productive in educational terms. Quality considerations include: range of hardware and software available, convenience, accessibility, availability of documentation and assistance, and simplicity of access. General campus awareness of computing may also be a good measure of quality and

maturity. This chapter suggests a technique for measuring and assessing quality.

"Measuring quantity" considers the inadequacy of much of the available information and the lack of generally accepted standards of measurement in this field. Three specific conclusions are put forward in the chapter. First, if we are to understand instructional computing better, we need better measures and better records of student use. Second, in these records, it is important that we be able to distinguish (at least) two levels, undergraduate and graduate; and (at least) distinguish major classes of users, such as computer science, science and engineering, and other students. Third, computing must be measured some terms other than (or in addition to) dollars.

Where do we go from here? The last chapters speak directly to the techniques of decision making on the individual campus and recommend methods for rationalizing and formalizing these techniques.

"Peer groups and institutional estimates" presents a technique for gathering information on the use of computers at "comparable" institutions, since many institutions find this an important way of establishing a norm.

"Self-study: assessing the need" reviews techniques of evaluating the consensus of those whose opinions matter to the institution: the faculty or some other group. A specific instrument and its method of application are presented.

"Priorities, allocation, and decisions" takes another broad look at the campus situation with regard to computing, sketches several alternatives, and makes recommendations for future study.

Different institutions have different ways to go and it is impossible to set down rules universally applicable to all universities and colleges. But the needs of students are not so diverse. All of them need to be educated in a computer-aided world. Institutions need to formulate goals and establish resources in terms of this need. What difference does computing make in education? As is the case with most educational activities, we can measure the inputs but the outputs, the results, the things that matter are more elusive. More efforts to measure the impact of computers on education are important. But taking advantage of the impact and improving the use of computers in instruction are more important still. The study urges better measures for both the computing itself and its influence on education. But it also advocates the importance of more and better computing than many students have access to today.

D. Publication

Several oral reports on the progress of the research have been presented, as follows:

"Computer Access for Students: Quantity and Quality," presented at meeting of Association for the Development of Computer-based Instructional Systems, Santa Barbara,

California, 27 January 1976.

"Pricing and Allocation Schemes," presented at meeting of ACM Special Interest Group on Computer Uses in Education, Anaheim, California, 11 February 1976.

"Establishing Criteria for Computers in Education," ACM Special Interest Group on University Computer Centers, St. Louis, Missouri, 9 April 1976.

Talks on the conclusions of the research are also scheduled for delivery at the National ACM meeting in Houston in October and a meeting on User Services sponsored by the ACM Special Interest Group on University Computer Centers in Tucson in November.

All of the interim reports of the project have been superceded by a major publication, Evaluating Instructional Computing, which reports on the research and its findings at some length. This report will be published by the University of California, Irvine, and is now in the press. It will be available in August of 1976.